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OMB Control Number: 0694-0119
Expiration Date: May 2013

DEFENSE INDUSTRIAL BASE ASSESSMENT:
U.S. Infrastructure for Underwater Acoustic Transduction Systems
University/Institution Survey

SCOPE OF ASSESSMENT

The U.S. Department of Commerce, Bureau of Industry and Security (BIS), Office of Technology Evaluation (OTE), in cooperation with the U.S. Department of the Navy, Office of Naval Research (ONR), is conducting an assessment of the U.S. Underwater Acoustics Transduction industry and related institutions. The purpose of this assessment is to analyze the health and competitiveness of the infrastructure and to develop recommendations for the U.S. Navy to ensure the ability of the industry and related institutions to support U.S. Navy missions and programs.

RESPONSE TO THIS SURVEY IS REQUIRED BY LAW

A response to this survey is required by law (50 U.S.C. App. Sec. 2155). Failure to respond can result in a maximum fine of $10,000, imprisonment of up to one year, or both. Information furnished herewith is deemed confidential and will not be published or disclosed except in accordance with Section 705 of the Defense Production Act of 1950, as amended (50 U.S.C. App. Sec. 2155). Section 705 prohibits the publication or disclosure of this information unless the President determines that its withholding is contrary to the national defense. Information will not be shared with any non-government entity, other than in aggregate form. The information will be protected pursuant to the appropriate exemptions from disclosure under the Freedom of Information Act (FOIA), should it be the subject of a FOIA request.

Not withstanding any other provision of law, no person is required to respond to nor shall a person be subject to a penalty for failure to comply with a collection of information subject to the requirements of the Paperwork Reduction Act unless that collection of information displays a currently valid OMB Control Number.

BURDEN ESTIMATE AND REQUEST FOR COMMENT

Public reporting burden for this collection of information is estimated to average 14 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information to BIS Information Collection Officer, Room 6883, Bureau of Industry and Security, U.S. Department of Commerce, Washington, D.C. 20230, and to the Office of Management and Budget, Paperwork Reduction Project (OMB Control No. 0694-0119), Washington, D.C. 20503.

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Introduction I	General Instructions
A.	Your company/organization is required to complete this **university/institution** survey using an Excel template, which can be downloaded from the BIS website: *http://www.bis.doc.gov/underwater_acoustics/index.htm* . At your request, BIS staff will e-mail the Excel survey template directly to your company/organization. For your convenience, a PDF version of the survey is available on the BIS website to aid internal data collection. DO NOT submit the PDF version of your company's response to BIS.
B.	Respond to every question. Surveys that are not fully completed will be returned for completion. Use comment boxes to provide any information to supplement responses provided in the survey form. Make sure to record a complete answer in the cell provided, even if the cell does not appear to expand to fit all the information. **DO NOT COPY AND PASTE RESPONSES WITHIN THIS SURVEY.** Survey inputs should be made manually by typing in responses or by use of a drop-down menu. The use of copy and paste can disrupt the data collection process. If your survey response is corrupted as a result of copy and paste responses, a new survey will be sent to you for immediate completion.
C.	**Do not disclose any classified relationships in this survey form.** Aggregated financials, employment, R&D expenditures, etc. are permitted.
D.	Questions related to this survey should be directed to: Matthew Sigmund, 202-482-0634; Laura DeMaria, 202-482-7804; or Mark Crawford, 202-482-8239. Alternatively, send e-mail to: underwateracoustics@bis.doc.gov
E.	If information is not available from your records in the form requested, contact our office to see if you may furnish estimates.
F.	Upon completion, and final review and certification of the survey, transmit the survey via e-mail to: underwateracoustics@bis.doc.gov
G.	For letter correspondence to the Office of Technology Evaluation regarding the overall scope of this assessment, please write to: Brad Botwin, Director, Industrial Studies Office of Technology Evaluation, Room 1093 U.S. Department of Commerce 1401 Constitution Avenue, NW Washington, DC 20230 Please do not submit completed surveys to this address; all surveys must be submitted electronically.

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Introduction II	Definitions
Acoustic Communications (ACOMMS)	An acoustic system designed to communicate (transmit or receive) acoustical data via an acoustic medium (water or air).
Acoustic Vector Sensor	A device that concurrently measures acoustic pressure and acoustic particle motion for the purpose of estimating intensity and direction of propagation of sound at a point in an acoustic field.
Active SONAR	An underwater acoustic system capable of transmission of acoustic signals.
Active Underwater Acoustic Transducer	An underwater transducer that can be used to transmit energy into the water.
Air-Deployed Sonar Systems	Any transducer-based system used for underwater acoustic signal generation or detection and installed on or deployed from aircraft.
Applied Research	Research for the purpose of applying knowledge or technologies to improve specific problems, devices, methods, or systems. Applied research often has a known potential application.
Autonomous underwater vehicles (AUV)	A self-propelled, independent system that travels underwater without requiring input from an operator.
Basic Research	Research resulting in new knowledge or improved understanding of subject area. Such research may also result in new discovery or invention of ideas, methods or devices.
Basic Research Underwater Acoustic Systems	Any transducer-based system or subsystem component used in basic research and/or testing for underwater acoustic signal generation or detection.
Capacity	The rated production capacity of a facility or production line to manufacture a standard product within a single, 8-hour shift.
Commercial And Government Entity Code (CAGE)	Commercial And Government Entity Code (CAGE Code) - A unique identifier assigned to suppliers to U.S. government or defense agencies for the purpose of identifying a specific facility and location. CAGE Codes (also known as NCAGE codes) are used internationally as part of the NATO Codification System (NCS).
Calibration	The process of testing a transducer to determine its performance including (but not limited to) its transmit or receive sensitivity, impedance in water, directional factor, and electroacoustic efficiency.
Calibration Facilities	Specialized facilities designed for measuring various transducer system responses to specific inputs (acoustic, shakers, signal telemetry, etc.).
Ceramic	Any piezoelectric, polycrystalline material based on ferroelectric oxides, such as lead zirconate titanate (PZT) ceramics.
Command Organization	Primary military organization (e.g., NAVSEA, NAVAIR, SPAWAR, etc.).
Company	Organizations including sole proprietorships, partnerships, companies, corporations and non-profit entities that operate as businesses (does not include universities).
Distributed Netted Systems	Any underwater acoustic sensor whose local information is subsequently combined through a data fusion process with information from other sources to produce an improved estimate of the state of the target population over a broader area and over a period of time that might exceed the immediate utility of an individual sensor in the network.
Division Facilities	Specialized facilities under the direction of a division within a larger command organization.
Educational Institution	Any institution providing college-level courses for academic credit.
Educational Program	A combination of courses from an educational institution leading to a certificate or degree.
Electrode Adhesion	The degree of adhesion of the electrode (e.g. silver, nickel, etc.) to the piezo element.
Electro-Dynamic Actuators and Force Drivers	Piezoelectric and other electromechanical actuators with the principal function of delivering a force or displacement as opposed to the radiation of sound.
Elements	Refers to finished components (e.g. ceramic disks, plates, rings, tubes, hemispheres, etc.) used in underwater transducers.
Environmental Parameters	Environmental parameters influencing acoustic propagation, e.g., temperature, pressure, density, bulk modulus, shear speed, attenuation, salinity, sound speed, etc.
Environmentally Controlled Facilities	Specialized measurement facilities in enclosed areas capable of manipulating environmental factors (e.g., temperature, pressure, etc.).

Facility	A physical space for performing specific work or activity.
Institutional Facility	A specialized design/manufacturing facility directly managed/owned by an educational institution.
International Traffic in Arms Regulations (ITAR)	Products and technologies subject to the Arms Export Control Act (AECA) [See 22 U.S.C 2778]
Integrated Electronics	The assemblage of electronic components on an electronic circuit board, membrane or other medium into a system.
Lake/Ocean Facilities	Specialized measurement facilities in lakes or open ocean ranges (e.g., Lake Pend Oreille, AUTEC, etc.).
Lead zirconate titanate (PZT)	An inorganic compound (Pb[ZrxTi1-x]O3 0≤x≤1). This ceramic perovskite material has piezoelectric effect properties useful for electroceramics.
Magnetics Design	The steps, procedures, and results associated with designing inductive tuning elements and impedance (step-up and step-down) transformers that are often necessary in an acoustic transducer subsystem.
Magnetostrictive materials	Ferromagnetic materials that convert mechanical energy into magnetic field displacements that alter the material shape when subjected to magnetization.
Manufacturing Standards	The standards and expectations associated with quality and tolerances related to a particular manufacturing process.
Medical Acoustic Systems	Any medical procedure (or system) that utilizes acoustics through the fluid medium of the body (e.g., ultrasound imaging, gallstone high intensity ensonification, etc.).
Material Bonding	The bonding of two or more materials.
National Security	A collective term encompassing national defense and homeland security, including the military, civilian intelligence agencies, border security, etc.
National Security Systems	Any transducer-based system that utilizes underwater acoustics for purposes of national security.
Near-Equivalent	A material, component, or product with performance characteristics that are within 10% of performance leaders.
Non-U.S. Customer	Any organization or company whose principle ownership is foreign.
Oceanographic	Relating to physical features of the oceans, e.g., temperature, depth, currents, waves, etc.
Oceanographic Systems	Underwater acoustic systems designed to measure oceanographic features, e.g., acoustic Doppler profilers, hydrographic systems, bathymetric systems, etc.
Passive Underwater Acoustic Sensor	A sensor that is capable of measuring incidents of acoustic energy.
Passive SONAR	An underwater acoustic (Sound, Navigation, and Ranging) system used to detect acoustic signals with receivers only (the system does not generate a probing acoustical signal).
Piezoceramic element	A piezoelectric ceramic element (such as a bar, plate, cylinder, etc.) made from a ceramic based composition exhibiting piezoelectric properties.
Piezocrystal element	A piezoelectric crystal element (such as a bar, plate, disk, etc.) made from a crystalline composition (such as quartz or PMN-PT single crystal) exhibiting piezoelectric properties.
Piezoelectric	The physical property of a material that converts electrical energy into mechanical energy (electromechanical piezoelectric effect) or mechanical energy into electrical energy (mechano-electric piezoelectric effect).
Potting	The process of enclosing (or so called potting) an acoustic transducer within a waterproof solid layer, usually comprised of polyurethane, rubber, or plastic.
Pound	16 ounces; 0.454 kilogram (kilogram = 2.2046 pounds)
Process Control	Methods and controls associated with manufacturing (or processing) piezoelectric materials and/or transducers.
Rated production capacity	The maximum engineered output capability of your production line based on the manufacture of a standard component or product in a single 8-hour shift.
R&D	Research and Development: All steps associated with the research and/or development of a product.

Research, Development, Test and Evaluation (RDT&E)	Research, Development, Test and Evaluation (RDT&E) - All steps associated with the full cycle of research and/or development, and subsequent testing and evaluation of product.
Single Crystal	Any relaxor-based, piezoelectric single crystal material, such as lead magnesium niobate-lead titanate (PMN-PT).
Sonar Transducer Reliability Improvement Program (STRIP)	A US Navy program with emphasis on reliability improvement of sonar transducers and support of devices used in the fleet (currently administered by NAVSEA/NUWC).
Sub-assembly	Any component of a system, which may or may not work independently.
Submarine Sonar Systems	Any transducer-based system used for underwater acoustic signal generation or detection and installed on submarines or deployed from submarines.
Surface Ship Sonar Systems	Any transducer-based system used for underwater acoustic signal generation or detection and installed on surface vessels, or deployed from surface vessels.
Technical Personnel/Engineering Force	Technically trained/educated workforce personnel who are directly involved with aspects of design and/or manufacturing of transducer products and SONAR systems.
Telemetry	Systems and subsystem components that involve the transmission of acoustic signals by wire, air, or water. Such systems may include conversion of signals to higher carrier frequencies or to different forms of energy such as electromagnetic, light, mechanical, or acoustical.
Transducer	Any device that converts acoustical energy into electrical energy, and vice-versa.
Transducer Components	Also known as "elements." Refers to finished components (e.g. ceramic disks, plates, rings, tubes, hemispheres, etc.) used in underwater transducers.
Transducer Design	The design and description of acoustical transducers (projectors and receivers) and related performance predictions or estimates.
Transducer Manufacturing	The building or production of acoustic transducers for commercial and/or government customers.
Transducer Products	Any transducer device or subsystem comprising an electroacoustic transducer that may be commercially available or made available to a navy or research application or demonstration.
Underwater Acoustic Communication Systems	Any transducer-based system used for underwater acoustic communications.
Underwater Acoustic Navigation Systems	Underwater Acoustic Navigation Systems reduce navigational uncertainty by providing acoustic information regarding position relative to known objects.
Underwater Imaging/Scanning Systems	Underwater Acoustic Imaging/Scanning Systems that create high resolution images of underwater structures, the bottom, and/or objects in the water column.
Underwater Transducer	Any device capable of converting acoustical energy into electrical energy, and vice-versa in an underwater environment.
Unmanned Underwater Vehicle (UUV)	Underwater vehicles that are either remotely operated vehicles (ROVs) operated by a person, or autonomous underwater vehicles (AUVs) that do not require human control.
U.S. Customer	Any organization or company whose principle ownership is U.S.-based.
UUV/AUV Underwater Acoustic Systems	Systems specifically intended to be integrated into unmanned/autonomous underwater vehicles for any undersea warfare or oceanographic purpose.

Technical References

ANSI S1.20-2012, Procedures for Calibration of Underwater Electroacoustic Transducers.

R. Bobber, Underwater Electroacoustic Measurements, Peninsula Publishing, 1990.

J.F. Zalesak, "Transfer coupler reciprocity: A new low-frequency coupler-reciprocity technique for the absolute calibration of field hydrophones under full environmental conditions," J. Acous. Soc. Am., Vol. 105, pp. 2342-2349, 1999.

J.A. McConnel, K.J. Bastyr and G.C. Lauchle, "Development of a velocity gradient underwater acoustic intensity sensor", J. Acous. Soc. Am., Vol. 105, pp. 3178 - 3188, 1999.

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Section 1.a	Who Must Respond	
A.	Has your university/institution taught courses or performed research related to the design, manufacture, and/or use of underwater transducers and/or sonar systems from 2009-2012?	
B.	Has your university/institution designed, manufactured, and/or prototyped materials, components or systems associated with underwater transducers and/or sonar systems from 2009-2012?	
C.	Has your university/institution received grants from any U.S. Government agency between 2009-2012 to performed research related to the design, manufacture, and/or use of underwater transducers and/or sonar systems from 2009-2012?	
D.	Has your university/institution performed research funded by the United States Navy related to the design, manufacture, and/or use of underwater transducers and/or sonar systems from 2009-2012?	
E.	Has your university/institution calibrated, tested, or performed repairs on undewater transducer and/or sonar systems from 2009-2012?	

Exemption From Survey

If you responded "No" to each of the five questions above and believe that your company/organization should be excused from completing the survey, send your request for exemption by e-mail to: underwateracoustics@bis.doc.gov. BIS staff will contact you to review your request.

Comments:	

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Section 1.b		University/Institution Information			
A.	University/Institution Name				
	Street Address				
	City				
	State				
	Zip Code				
	Phone Number				
	Fax Number				
	Website				
B.	Point of Contact(s) regarding this survey:				
	Name	Title	E-mail	Phone Number	
	Institution to Department of Commerce -- Comments:				

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Section 2.a **Educational Program Information**

Profile the types of courses offered by your university/institution related to acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems by responding to the questions below. Respond to all cells.

A.	Identify the types of general acoustics courses taught by your university/institution.	Fundamentals of Acoustics	
		Architectural Acoustics	
		Computational Acoustics	
		Material Properties & Acoustics	
		Medical Acoustics	
		Musical Acoustics	
		Noise Control Acoustics	
		Underwater Acoustics/Digital Communications	
		Vibration Acoustics	
		Other (Please report in space below.)	
	Comments:		
B.	State the **number of courses** taught by your university/ institution that are focused primarily on the following subject matter:	Acoustic Laboratory Methods	
		Signal Processing	
		SONAR Systems Engineering	
		Transducer Engineering	
		Transduction Material Science	
		Transduction Science	
		Underwater Acoustic Propagation	
		Other Categories of Related Courses (list)	
	Comments:		
C.	Identify the **types of transducer technologies** taught by your university/institution.	**Piezoelectric Transducer - utilizing piezoceramics**	
		Piezoelectric Transducer - utilizing piezocrystals	
		Other Types of Transducer Technologies	
		Acoustic motion, pressure gradient	
		Electrostatic or Capacitive	
		Electrodynamic (moving coil)	
		Explosive and Impulsive Air	
		Hydrodynamic and Magneto-Hydrodynamic	
		Fiber Optic (receiver only)	
		Magnetic or Variable Reluctance	
		Magnetostrictive	
		Other types (Please report in space below.)	
	Comments:		
D.	Does your **course curricula** address the following transducer types and geometries?	Spherical transducers/simple sources	
		Cylindrical	
		Rod or bar type transducers	
		Tonpilz transducers	
		Flexural plate or disk transducers	
		Flextensional transducers	
		Other geometries, types (Please report in space	
	Comments:		
E.	Does your university/institution teach transducer design in its classes?		
F.	Does your university/institution teach transducer manufacturing in its classes?		
G.	Estimate the number of classroom instruction hours for this specific program that are devoted to:	Piezoelectric transducers	
		Non-piezoelectric transducers	
		Laboratory training, testing, or demonstration of piezoelectric transducers.	
	Comments:		

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Section 2.b **Educational Program Information: Programs 1 - 2**

State the title and type of all certificate or degree programs currently offered by your university/institution involving the field of acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems. Respond to all cells.

List each type of program use a separate survey template (See Tabs 2.b - 2.f. If you require more pages, contact Mark Crawford at 202-482-8239, mark.crawford@bis.doc.gov.

1.	a.	**Title of Program 1:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

2.	a.	**Title of Program 2:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

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Section 2.c **Educational Program Information: Programs 3 - 4**

State the title and type of all certificate or degree programs currently offered by your university/institution involving the field of acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems. Respond to all cells.

List each type of program use a separate survey template (See Tabs 2.b - 2.f). If you require more pages, contact Mark Crawford at 202-482-8239, mark.crawford@bis.doc.gov.

3.	a.	**Title of Program 3:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	

3. d. List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

4.	a.	**Title of Program 4:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	

4. d. List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

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Section 2.d **Educational Program Information: Programs 5 - 6**

State the title and type of all certificate or degree programs currently offered by your university/institution involving the field of acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems. Respond to all cells.

List each type of program use a separate survey template (See Tabs 2.b - 2.f. If you require more pages, contact Mark Crawford at 202-482-8239, mark.crawford@bis.doc.gov.

5.	a.	**Title of Program 5:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

6.	a.	**Title of Program 6:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

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Section 2.e **Educational Program Information: Programs 7 - 8**

State the title and type of all certificate or degree programs currently offered by your university/institution involving the field of acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems. Respond to all cells.

List each type of program use a separate survey template (See Tabs 2.b - 2.f. If you require more pages, contact Mark Crawford at 202-482-8239, mark.crawford@bis.doc.gov.

7.	a.	**Title of Program 7:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

8.	a.	**Title of Program 8:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

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Section 2.f **Educational Program Information: Programs 9 - 10**

State the title and type of all certificate or degree programs currently offered by your univeersity/institution involving the field of acoustics, underwater acoustics, acoustic transducers, and/or SONAR systems. Respond to all cells.

List each type of program use a separate survey template (See Tabs 2.b - 2.f. If you require more pages, contact Mark Crawford at 202-482-8239, mark.crawford@bis.doc.gov.

9.	a.	**Title of Program 9:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

10.	a.	**Title of Program 10:**	**Type of Program** (Ph.D., certificate, etc.):
	b.	**Category of Certificate/Program** *(Select one from the drop-down list) >>*	
	c.	Year this program was initiated:	
	d.	List the active courses in acoustics offered by your university/institution in years 2009 -2012 that are associated with the program identified above:	

1.		6.		11.	
2.		7.		12.	
3.		8.		13.	
4.		9.		14.	
5.		10.		15.	

Comments:

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Section 3.a **Types of Support Provided to University Acoustic Education Programs**

Identify all private companies, individuals, foundations, government entities, and other organizations that provide funding, equipment, materials, and/or substantial technical assistance to your university/institution to support instruction programs associated with acoustic transducer design, calibration, manufacturing, research, and/or testing. Provide the address of each contributing organization. Finally, specify the types of equipment and/or materials that are provided either through gifts/grants, loans, purchase, research collaborations, or work contracts.

		Company/Organization Name	City	State (if applicable)	Country	Support Provided		Form of Support
						Types of Equipment	Types of Material	
A.	1.							
	2.							
	3.							
	4.							
	5.							
	6.							
	7.							
	8.							
	9.							
	10.							
	11.							
	12.							
	13.							
	14.							
	15.							
	16.							
	17.							
	18.							
	19.							
	20.							
	21.							
	22.							
	23.							
	24.							
	25.							

Comments:

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Section 3.b **Student Trends and Support**

A. By type of degree pursued, specify the number of U.S. students and Non-U.S. students enrolled in programs in 2011 related to underwater acoustics and transduction. Respond to each cell.

Note: "Non-U.S. students" includes Green Card and H1-B Visa Holders.

Student Type	Students - Number of U.S. Citizens	Students - Number of Non-U.S. Citizens
Ph.D. Students in Acoustics Program		
Ph.D. Dissertations in 2011 related to Transducers		
Masters Students in Acoustics Program		
Master's Theses in 2011 related to Transducers		
Undergraduate Students in Acoustics Program		
Undergraduate Projects/Honors Theses in 2011 related to Transducers		
Other (specify)		
Other (specify)		
Other (specify)		

B. For the student population enrolled in 2011 and described in question 3.b-A, identify the top 3 forms of financial support received (based on U.S. dollar equivalents). Use the categories provided in the drop-down boxes. Respond to each cell.

Student Type	Primary Support	Secondary Support	Tertiary Support
U.S. Citizen Ph.D. Students			
U.S. Citizen Masters Students			
U.S. Citizen Undergraduate Students			
Non-U.S. Citizen Ph.D. Students			
Non-U.S. Citizen Masters Students			
Non-U.S. Citizen Undergraduate Students			
Other (specify)			
Other (specify)			
Other (specify)			

C. For the student types listed below, report the average annual enrollment for the five 2-year reporting periods shown below. Respond to each cell.

Student Type	2004-2005	2006-2007	2008-2009	2010-2011	2011-2012
U.S. Citizen Ph.D. Students					
U.S. Citizen Masters Students					
U.S. Citizen Undergraduate Students					
Non-U.S. Citizen Ph.D. Students					
Non-U.S. Citizen Masters Students					
Non-U.S. Citizen Undergraduate Students					
Other (specify) 0					
Other (specify) 0					
Other (specify) 0					

D. For the 2008-2012 period, estimate the percentage (average) of your graduated students who have found employment in the sectors identified below. Respond to each cell.

Student Type	DoD/ Other U.S. Gov.	Academia	U.S. Industry/ Commercial	Non-U.S. Government	Non-U.S. Industry/ Commercial	Other	Total (must equal 100%)
U.S. Citizen Ph.D. Students							0%
U.S. Citizen Masters Students							0%
Non-U.S. Citizen Ph.D. Students							0%
Non-U.S. Citizen Masters Students							0%

Comments:

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Section 4.a Facilities Supporting Underwater Acoustic Transducer Education - INTERNAL

Instruction: If your university/institution does not operate calibration/testing facilities, then check "None" in the box at right and proceed to Section 4.b.

A. Identify the 1) types of testing facilities and associated capabilities that exist at your university/institution to support its education and research programs in underwater acoustic transduction, and 2) how these facilities are used. Provide written comments on testing facilities not identified in the survey form. Respond to all cells.

Facility Type	Facility Present at University/Institution?	Use #1 of Facility	Use #2 of Facility	Use #3 of Facility	Use #4 of Facility
Small Ultrasonic Test Tanks					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Medium-size acoustic test tanks (e.g., test tanks up to 5,000 gallons)					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Large-size acoustic test tanks (e.g., test tanks up to 50,000 gallons)					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Standing wave acoustic enclosures (open or closed surfaces)					
Open water test facilities (on pond, lake, inlet or other)					
Provisions for testing in salt water					
Pressurized test chambers for testing transducer properties under hydrostatic pressure.					
Temperature test chambers for testing transducer properties under temperature control.					
Combined pressure and temperature chambers for acoustic testing.					
In air, anechoic test cambers.					

Other specialized or supporting acoustic test equipment not stated above. Please list in space provided below:

1.
2.
3.
4.
5.

Comments:

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Section 4.b **Facilities Supporting Underwater Acoustic Transducer Education - INTERNAL (cont.)**

Instruction: If your university/institution does not operate internal calibration/testing facilities, then check "None" in the box at right and proceed to Section 4.b.

Identify all **internal** testing facilities at your university/institution to support your education and research programs in underwater acoustic transduction. Blank responses mean that your institution does not currently utilize any facilities.

A.	a.	Institutional Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
B.	a.	Institutional Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
C.	a.	Institutional Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
D.	a.	Institutional Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
E.	a.	Institutional Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	

Comments:

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Section 4.c **Facilities Supporting Underwater Acoustic Transducer Education - EXTERNAL**

Instruction: If your university/institution does not utilize **external** calibration/testing facilities, then check "None" in the box at right and proceed to Section 5.

Identify the 1) types of **external** testing facilities and associated capabilities that your university/institution utilizes to support its education and research programs in underwater acoustic transduction, and 2) how the **external** facilities are used. Provide written comments on testing facilities not identified in the survey form. Respond to all cells.

A.

External Facility/Capability Type	External Facility Used?	Use #1 of Facility	Use #2 of Facility	Use #3 of Facility	Use #4 of Facility
Small Ultrasonic Test Tanks					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Medium-size acoustic test tanks (e.g., test tanks up to 5,000 gallons)					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Large-size acoustic test tanks (e.g., test tanks up to 50,000 gallons)					
Impedance analyzer available for use for transducers					
Dynamic spectrum analyzer (frequency response measurements)					
Calibrated acoustic sources dedicated for this test tank					
Calibrated acoustic receivers dedicated for this test tank					
Automated calibration instrumentation and data acquisition for above					
Standing wave acoustic enclosures (open or closed surfaces)					
Open water test facilities (on pond, lake, inlet or other)					
Provisions for testing in salt water					
Pressurized test chambers for testing transducer properties under hydrostatic pressure.					
Temperature test chambers for testing transducer properties under temperature control.					
Combined pressure and temperature chambers for acoustic testing.					
In air, anechoic test cambers.					

Other specialized or supporting acoustic test equipment not stated about. Please list in space provided below:

1.
2.
3.
4.
5.

Comments:

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Section 4.d Facilities Supporting Underwater Acoustic Transducer Education - EXTERNAL (cont.)

Instruction: If your university/institution does not utilize External calibration/testing facilities, then check "None" in the box at right and proceed to Section 5.

Identify all **external** testing facilities at your university/institution to support your education and research programs in underwater acoustic transduction. Blank responses mean that your institution does not currently utilize any facilities.

A.	a.	External Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
B.	a.	External Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
C.	a.	External Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
D.	a.	External Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	
E.	a.	External Facility Name:	
	b.	Description of capabilities (including special capabilities):	
	c.	State whether this facility is used for:	
	d.	How many of your institution's classes dealing with underwater acoustic transduction are supported by this facility annually?	
	e.	How many research projects dealing with underwater acoustic transduction were supported by this facility between 2008-2011?	

Comments:

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Section 5.a **Calibration: Calibration/Testing of Underwater Acoustic Transducer Products - Receivers**

Specify your university's/institution's capabilities to calibrate and/or test underwater acoustic transducers in accordance with each technical specification listed below. For every technical specification, indicate whether your company/organization plans to maintain or alter its capability through 2015. Respond to all cells.

A.

Technical Specifications for Receiver Calibration	Mode of Calibration*			Retention of Capability Through 2015?
	Physics-Based Calibration	U.S.G. Certified Standard	Other (Specify in Comments)	
Free Field Voltage Sensitivity (FFVS) Primary Calibration Methods				
Conventional / Free Field Reciprocity (Bobber 2.3.1)				
Two Transducer Reciprocity (Bobber 2.3.2)				
Self Reciprocity (Bobber 2.3.3)				
Cylindrical Wave Reciprocity (Bobber 2.3.4)				
Plane Wave Reciprocity (Bobber 2.3.5)				
Tube Reciprocity - Propagating Wave (Bobber 2.3.6)				
Coupler Reciprocity (Bobber 2.3.7)				
Transfer Coupler Reciprocity (Zalesak)				
Two Projector Null Method (Bobber 2.4)				
Free Field Voltage Sensitivity (FFVS) Secondary Calibration Methods				
Comparison Calibrations				
Free Field Comparison Calibration (Bobber 2.2.1)				
Standard Projector Calibration (Bobber 2.2.2)				
Small Tank Calibration (Bobber 2.2.3)				
Impedance Method Calibrations				
Compliance Controlled (Bobber 2.5.1)				
Inertia Controlled (Bobber 2.5.2)				
Static (Low Frequency) Calibration Methods				
Dunking Machine (Bobber 2.6.3)				
Golendov Calibrator (Bobber 2.6.3)				
Pressure Gradient / Particle Velocity Measurements				
Free Field Calibration (Bobber 2.10)				
Standing Wave Calibration				
Rigid Walled tube (Bobber 2.10)				
Compliant/Slow Wave Tube (Bastyr, Lauchle and McConnell)				
Electrical Impedance / Admittance				
Efficiency				
Direct Method (Bobber 2.14.1)				
Impedance Method (Bobber 2.14.2)				
Dynamic Range - Hydrophone (Bobber 2.15)				
Linearity - Projector and Receiver (Bobber 2.15)				
Equivalent Noise Pressure (Bobber 2.16.2)				
Directivity Patterns				
Far Field				
Near Field				
Uniform Radiator				
Non-uniform Radiator				
Beam Width				
Minor Lobe Level				
Directivity Factor / Index				
Parameter Ranges				
Frequency range and resolution				
Temperature range				
Pressure range				
Angular resolution for beam patterns				
Nominal uncertainty				

B. State the degree of measurement accuracy that your company/organization is capable of achieving in its calibration and/or testing of underwater acoustic transducers.

	Degree of Accuracy
Magnetic Orientation	
Inertial Orientation (Gravitational)	

*Physics-based calibration from first principles on devices using an approved method. Comparative measurements from/ to the device to those taken simultaneously from a device certified by

Comments:

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Section 5.b **Calibration: Calibration/Testing of Underwater Acoustic Transducer Products - Projectors**

A. Specify your university's/institution's capabilities to calibrate and/or test underwater acoustic transducers in accordance with each technical specification listed below.

Technical Specifications for Projector Calibration	Mode of Calibration*			Retention of Capability Through 2015?
	Physics-Based Calibration	U.S.G. Certified Standard	Other (Specify in Comments)	
Transmit Voltage Response				
Transmit Current Response				
Source Level Maximum				
Efficiency				
Direct Method (Bobber 2.14.1)				
Impedance Method (Bobber 2.14.2)				
Linearity (Bobber 2.15)				
Electrical Impedance / Admittance				
Directivity Patterns				
Far Field				
Near Field				
Uniform Radiator				
Non-uniform Radiator				
Beam Width				
Minor Lobe Level				
Directivity Factor / Index				
Parameter Ranges				
Frequency range and resolution				
Temperature range				
Pressure range				
Angular resolution for beam patterns				
Nominal uncertainty				

B. State the degree of measurement accuracy that your company/organization is capable of achieving in its calibration and/or testing of underwater acoustic transducers.

	Degree of Accuracy
Magnetic Orientation	
Inertial Orientation (Gravitational)	

*Physics-based calibration from first principles on devices using an approved method. Comparative measurements from/to the device to those taken simultaneously from a

Comments:

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Section 5.c **Calibration: Capability to Calibrate/Test Specific Underwater Acoustic Transducers and Transducer Arrays**

Identify your university's/institution's capability to calibrate and/or test each of the acoustic transducer and transducer arrays listed in accordance with technical specifications contained in the footnote* below.
For each device/system, state whether your company/organization plans to maintain or alter its capability through 2015. Respond to all cells.

	Acoustic Underwater Devices	Testing/Calibration Capability by Type of Application							Prospect for Retention of Calibration/Testing Capability Through 2015?	For organizations reporting that their capabilities will decline by 2015, identify the primary cause for this change.
		Military	Geophysical	Oceanographic	Hydrographic Survey	Object Detection	Array Shape	Other (Specify in comment box)		
	Acoustic Receivers									
	Reference Standard Hydrophones (Primary Calibration)									
	Hydrophones (Secondary Calibration)									
	Hydrophone Arrays									
	Line Array									
	Planar Array									
	Cylindrical Array									
	Spherical Array									
	Other Array									
	Acoustic Vector Field Sensors									
	Acoustic particle displacement									
	Acoustic particle velocity									
	Acoustic particle acceleration									
	Pressure gradient sensor									
A.	Seismic Accelerometer Sensor									
	Seismic Velocity / Geophone Sensor									
	Vector Field Array									
	Line Array									
	Planar Array									
	Other Array									
	Hybrid Sensors (e.g. ocean bottom seismometer with hydrophone)									
	Acoustic Projectors									
	Piezoelectric Ceramic Projectors									
	Flextensional Projector									
	Slotted Cylinder Projector									
	Moving Coil Projector									
	Impulsive Sources									
	Air Gun									
	Combustive Sound Source									
	Projector Arrays									
	Line Array / Seismic streamer									
	Planar Array									
	Cylindrical Array									
	Spherical Array									
	Other Array (specify)									

*Physics-based calibration from first principles on devices using an approved method. Comparative measurements from/to the device to those taken simultaneously from a device certified by the U.S. Navy or other U.S. Government entity.

Comments:

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Section 6 **Supply of Materials/Components for Active Underwater Transducer and Passive Underwater Sensor Education/Research**

A. My university/institution obtains piezoceramic materials from:

Note: Respondent universities/institutions that rely on "internal production" for 100% of their material needs must complete Part 3d.B. Under "Supplier Name" state your university/institution name. Also, provide the location of each production facility you operate and identify the types of materials produced at these locations. DO NOT complete Part 3d.C.

B. Identify your company's/organization's U.S.-based and Non-U.S. suppliers for **piezoceramic materials**. Provide the supplier name and location, identify the types of materials supplied, and specify the average lead-time (in weeks) to receive piezoceramic materials from the supplier.

	Supplier Name	City	State	Country	Average Lead-Time for Delivery (in Weeks)	Material Type (Respond to each cell)													
						Navy Type I	Navy Type II	Navy Type III	Navy Type IV	Navy Type V	Navy Type VI	Polyvinylidene Fluoride (PVDF)	Single Crystal PMN-PT	Single Crystal PIN-PMN-PT	Galfenol	Terfenol-D	Lithium Sulfate	Generic Composites (e.g.,1-3 composites)	Other (specify)
1.																			
2.																			
3.																			
4.																			
5.																			
6.																			
7.																			
8.																			
9.																			
10.																			

Comments:

C. If your university's/institution's utilizes Non-U.S. suppliers for piezoceramic materials and/or other piezo materials, is there a near-equivalent U.S.-based supplier available?
If "Yes," identify the U.S. supplier(s), specify the material type(s), and describe your reasons for not utilizing the U.S.-based suppliers in the comment box below.

	Supplier Name	City	State	Material Type (Respond to each cell)													
				Navy Type I	Navy Type II	Navy Type III	Navy Type IV	Navy Type V	Navy Type VI	Polyvinylidene Fluoride (PVDF)	Single Crystal PMN-PT	Single Crystal PIN-PMN-PT	Galfenol	Terfenol-D	Lithium Sulfate	Generic Composites (e.g.,1-3 composites)	Other (specify)
1.																	
2.																	
3.																	
4.																	
5.																	

Reasons for not using U.S.-based suppliers:

Comments:

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Section 8 **Research and Development**

State your university's/institution's: 1) total (internal and external funded) research and development (R&D) dollar expenditures, 2) the type of R&D performed by percent allocation, 3) the percentage of total R&D expenditures relating exclusively to underwater transduction business lines, and 4) your university's/institution's R&D funding sources by percent of total R&D dollars. Respond to all cells.

Source of R&D Data:						
R&D Reporting Schedule:						
A.	**R&D Expenditures**		Record $ in Thousands, e.g., $12,000.00 = survey input of $12			
			2009	2010	2011	2012 Estimated
	1.	Total R&D Expenditures				
	2.	Basic Research (as a percent of Line 1)				
	3.	Applied Research (as a percent of Line 1)				
	4.	Product/Process Development (as a percent of Line 1)				
	5.	Total (must equal 100% of Line 1)	0%	0%	0%	0%
	6.	R&D Expenditures exclusively for Underwater Transducer business (as a percent of Line 1)				
B.	**R&D Funding Sources**		Record $ in Thousands, e.g., $12,000.00 = survey input of $12			
			2009	2010	2011	2012 Estimated
	1.	Total R&D Funding Sources				
	2.	Internal/Self-Funded/IRAD (as a percent of Line 1)				
	3.a	Total Federal Government (as a percent of Line 1)				
	3.b	Federal funding from SBIR/STTR program (as a percent of Line 3.a)				
	4.	Total State and Local Government (as a percent of Line 1)				
	5.	Universities - Public and Private (as a percent of Line 1)				
	6.	U.S. industry, venture capital, non-profit (as a percent of Line 1)				
	7.	Non-U.S. investors (as a percent of Line 1)				
	8.	Other (specify)				
	9.	Total (must equal 100% of Line 1)	0%	0%	0%	0%

Comments:

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Section 8 **Faculty Workforce/Employment**

State the 1) number of faculty (full-time equivalent - FTE) at your university/institution in 2012 that support courses/programs (e.g. architectural acoustics, sonar engineering, physics, etc.) related to **underwater acoustical transduction** for 2009-2012**,** 2) the level of change for 2009-2012 in the number of faculty (FTE) supporting courses related to underwater acoustics in the last three years, 3) the number faculty research journal publications for 2009-2012 related to underwater acoustical transduction. Respond to each cell.

Note: For the purpose of this survey, "Non-U.S. Citizens" includes Green Card and H1-B Visa Holders.

			U.S. Citizens	Non-U.S. Citizens	Total
A.		Total acoustics-related faculty at Institution			0
B.	1.	Faculty with expertise in underwater acoustics :			0
	2.	Of this number, how many are eligible to retire within next 5 years?			0
C.	1.	Faculty teaching courses in underwater acoustics-related disciplines:			0
	2.	Of this number, how many are eligible to retire within next 5 years?			0
D.	1.	Faculty who teach courses in acoustic design, engineering, or manufacturing:			0
	2.	Of this number, how many are eligible to retire within next 5 years?			0
E.		State the expected change in the number of academic full-time equivalent positions with expertise in underwater acoustics design/manufacturing over the next 5 years (0, +/-1, +/-2, etc.)			0
F.		State the number of faculty research journal publications between 2008-2011 related to underwater acoustics design, engineering, and/or manufacturing.			0
G.		Does your university/institution plan to hire faculty with general expertise in underwater acoustics within the next 5 years? If so, how many?	**U.S. Citizens**	**Non-U.S. Citizens**	**# of Faculty Hiring**

Comments:	

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Section 9	Certification
The undersigned certifies that the information herein supplied in response to this questionnaire is complete and correct to the best of his/her knowledge. It is a criminal offense to willfully make a false statement or representation to any department or agency of the United States Government as to any matter within its jurisdiction (18 U.S.C.A. 1001 (1984 & SUPP. 1197))	
University/Institution Name	
University/Institution Internet Address	
Name of Authorizing Official	
Title of Authorizing Official	
E-mail Address	
Phone Number and Extension	
Date Certified	
If POC is different from the above named, include below:	
Point of Contact Name	
Title of Point of Contact	
E-mail Address	
Phone Number and Extension	
Would you like a free copy of the final report?	
In the box below, please provide any additional comments or any other information you wish to include regarding this assessment.	
How many hours did it take to complete this survey?	

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